Introducing the Specifications of the MEF

An Overview of MEF 6.1, 6.1.1, 10.2, 10.2.1 Carrier Ethernet Definitions and Attributes

2012 March

Agenda

- **Approved MEF Specifications**
- **This Presentation**
- **About these Specification**
- **Terminology, Concepts**
- **Section Review**
  - Major topics
    - Minor topics
- **Examples/Use Cases**
- **Summary**

MEF

Approved MEF Specifications

REF	Description
MEF 2	Requirements and Framework for Ethernet Service Protection
MEF 3	Circuit Emulation Service Definitions, Framework and Requirements in Metro Ethernet Networks
MEF 4	Metro Ethernet Network Architecture Framework Part 1: Generic Framework
MEF 6.1	Metro Ethernet Services Definitions Phase 2
MEF 6.1.1	Layer 2 Control Protocol Handling Amendment to MEF 6.1
MEF 7.1	EMS-NMS Information Model
MEF 8	Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks
MEF 9	Abstract Test Suite for Ethernet Services at the UNI
MEF 10.2	Ethernet Services Attributes Phase 2*
MEF 10.2.1	Performance Attributes Amendment to MEF 10.2
MEF 11	User Network Interface (UNI) Requirements and Framework
MEF 12	Metro Ethernet Network Architecture Framework Part 2: Ethernet Services Layer
MEF 13	User Network Interface (UNI) Type 1 Implementation Agreement
MEF 14	Abstract Test Suite for Traffic Management Phase 1
MEF 15	Requirements for Management of Metro Ethernet Phase 1 Network Elements
MEF 16	Ethernet Local Management Interface

*** MEF 6.1 replaced MEF 6., MEF 7.1 replaced MEF 7, MEF 10.2.1 & MEF 10 .2 replaced MEF 10.1.1, MEF 10.1, MEF 10 which replaced MEF 1 and MEF 5.**

Approved MEF Specifications

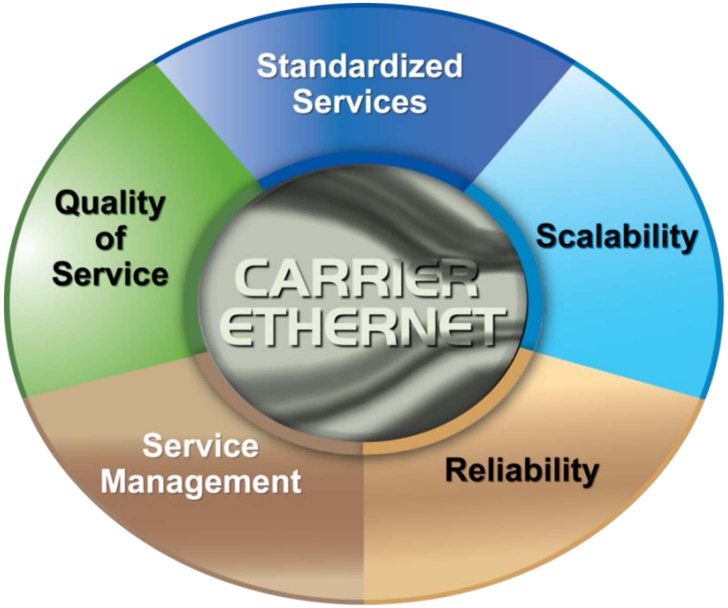
REF	Description
MEF 17	Service OAM Framework and Requirements
MEF 18	Abstract Test Suite for Circuit Emulation Services
MEF 19	Abstract Test Suite for UNI Type 1
MEF 20	User Network Interface (UNI) Type 2 Implementation Agreement
MEF 21	Abstract Test Suite for UNI Type 2 Part 1: Link OAM
MEF 22	Mobile Backhaul Implementation Agreement Phase 1
MEF 23	Class of Service Implementation Agreement Part 1
MEF 24	Abstract Test Suite for UNI Type 2 Part 2: E-LMI
MEF 25	Abstract Test Suite for UNI Type 2 Part 3: Service OAM
MEF 26	External Network Network Interface (ENNI) – Phase 1
MEF 27	Abstract Test Suite For UNI Type 2 Part 5: Enhanced UNI Attributes & Part 6: L2CP Handling
MEF 28	External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI
MEF 29	Ethernet Services Constructs
MEF 30	Service OAM Fault Management Implementation Agreement
MEF 31	Service OAM Fault Management Definition of Managed Objects
MEF 32	Requirements for Service Protection Across External Interfaces
MEF 33	Ethernet Access Services Definition

This Presentation

- **Purpose:**
  - Introduction to MEF 6.1, MEF 6.1.1, MEF 10.2 and MEF 10.2.1
  - Highlights of MEF 6.1 Services and Service Attributes.
  - This presentation does not cover examples of all Services and Service Attributes
- **Audience**
  - Most importantly, Subscribers of Ethernet Services
  - Equipment Manufacturers supporting MEF 6.1 Services using Service Attributes defined in MEF 10.2 & MEF 10.2.1.
  - Service Providers supporting MEF 6.1 Services
- **Other Documents**
  - Presentations of the other specifications and an overview of all specifications is available on the MEF web site
  - Other materials such as white papers and case studies are also available

Key Carrier Ethernet Definitions and Concepts

Provides foundational definitions and concepts for Metro Ethernet Services, service attributes and parameter requirements and as well as traffic classification, traffic profiles and related recommendations to deliver Carrier Ethernet Services.



Overview of MEF 6.1, MEF 6.1.1, 10.2, 10.2.1

MEF Specification Overview

MEF 6.1	**Metro Ethernet Services Definitions Phase 2**
Purpose	Defined Service types (E-Line, E-Lan, E-Tree) and standardizes few services based onthe the Service Types (EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE, EVP-TREE)"
MEF 6.1.1	**Amendment to MEF 6.1: Layer 2 Control Protocol**
Purpose	Aligns Layer 2 Control Protocol treatment at MEF compliant UNI to be consistent with IEEE specifications.
MEF 10.2	**Ethernet Services Attributes Phase 2**
Purpose	Defines the service attributes and parameters required to offer the services defined in MEF 6.1. Updated from Original MEF 10 and 10.1
MEF 10.2.1	**Performance Attributes Amendment to MEF 10.2**
Purpose	Redefine the service performance parameters concerning availability, resiliency, and handle related issues. Modifies specific sections in 10.2.
Audience	All, since they provide the fundamentals required to build devices and services that deliver Carrier Ethernet. For Enterprise users it gives the background to Service Level Specifications for Carrier Ethernet Services being offered by their Service Providers and helps to plan Ethernet Services as part of their overall network.

Terminology, Concepts & Relationship to other standards

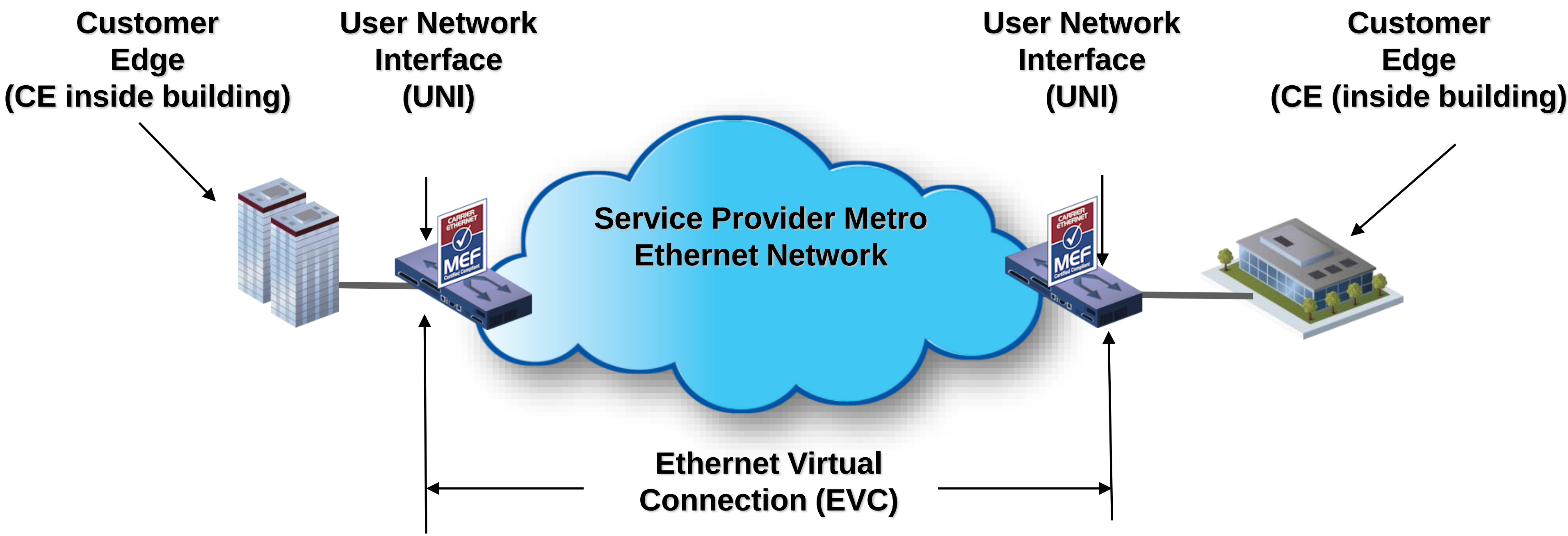
Terminology & Concepts

- **Services model and taxonomy**
- **Services type definitions**
- **Service attributes and parameters**
  - Per UNI
  - EVC per UNI
  - Per EVC

* Refer to the MEF specification documents for details on all attributes.

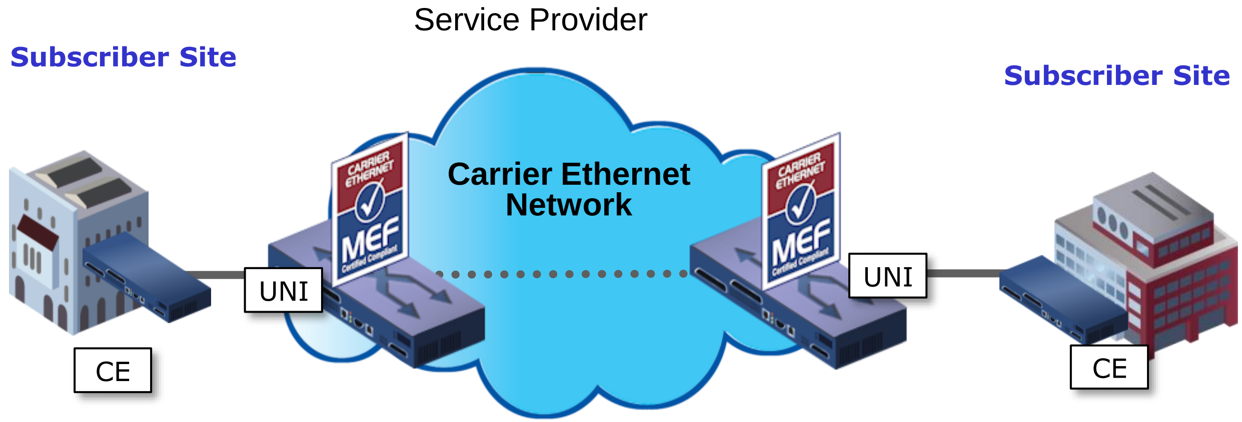
Ethernet Service - Reference Diagram

- Customer's (Subscriber) Service extends from UNI to UNI
- Connectivity between UNIs is an Ethernet Virtual Connection (EVC)



Ethernet Service – Basic MEF Model Concepts

- Customer Equipment (CE) attaches to the Carrier Ethernet Network at the UNI
- CE can be
  - Router, bridge/switch or Host (end system)
- UNI (User Network Interface)
  - Demarcation point between the customer (subscriber) and provider network
  - Standard IEEE 802.3 Ethernet PHY/MAC
- Carrier Ethernet Network is also referred to as a Metro Ethernet Network (MEN)



MEF Carrier Ethernet Terminology

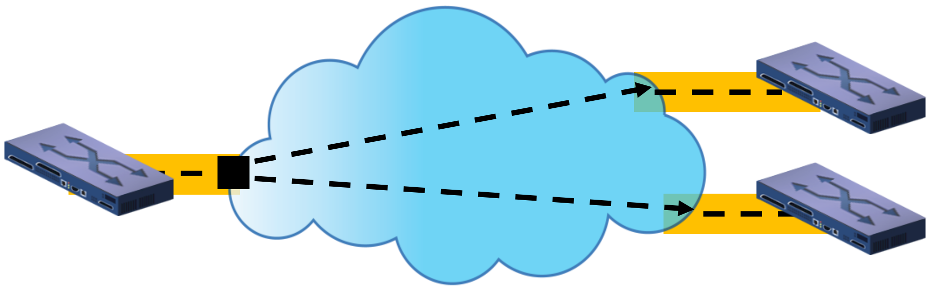
- **Ethernet Virtual Connection (EVC)**
  - Connects two or more UNI's
  - Between UNIs that are associated with the same EVC
  - Three types of EVCs
    - Point-to-Point
    - Multipoint-to-Multipoint
    - Rooted Multipoint
  - One or more VLANs can be mapped (bundled) to a single EVC
  - A UNI can support up to 4K EVCs
  - Defined in MEF 10.2 (Ethernet Services Attributes)

Attributes

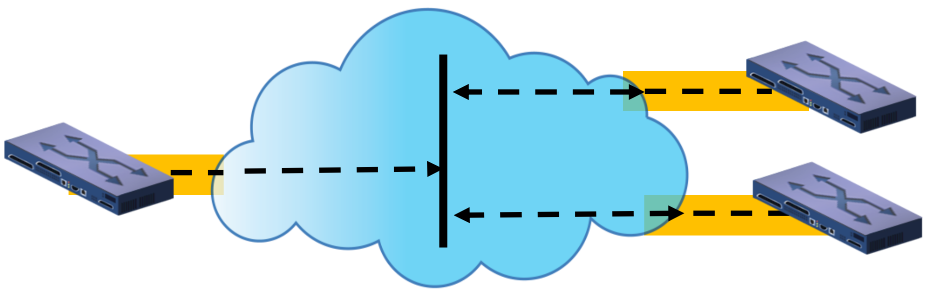
UNI Service Attribute	EVC per UNI Service Attribute	EVC Service Attribute
UNI Identifier	UNI EVC ID	EVC Type
Physical Medium	CE-VLAN ID / EVC Map	EVC ID
Speed	Ingress Bandwidth Profile Per EVC	UNI List
Mode	Ingress Bandwidth Profile Per CoS Identifier	Maximum Number of UNIs
MAC Layer	Egress Bandwidth Profile Per EVC	EVC MTU size
UNI MTU Size	Egress Bandwidth Profile Per CoS Identifier	CE-VLAN ID Preservation
Service Multiplexing		CE-VLAN CoS Preservation
Bundling		Unicast Service Frame Delivery
All to One Bundling		Multicast Service Frame Delivery
CE-VLAN ID for untagged and priority tagged Service Frames		Broadcast Service Frame Delivery
Maximum number of EVCs		Layer 2 Control Protocol Processing (only applies for L2CPs passed to the EVC)
Ingress Bandwidth Profile Per UNI		EVC Performance
Egress Bandwidth Profile Per UNI		
Layer 2 Control Protocols Processing		

Three Types of EVC’s

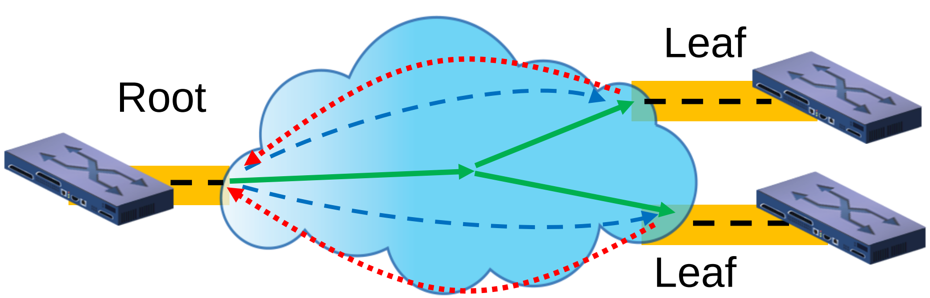
1. **Point to Point EVC: each EVC associates exactly 2 UNIs – in this diagram one site is connected to two other sites with two EVCs**



2. **Multipoint to Multipoint EVC: each EVC associates ≥ 2 UNIs – in this diagram, three sites joint share a multipoint EVC and can forward Ethernet frames to each other**



3. **Rooted Multipoint EVC : each EVC associates ≥ 2 UNIs with 1 or more UNIs as Roots – The roots can forward to the leaves, each leaf can only forward to the roots**



Broadcast, multicast and unicast unknown **Known unicast** **Broadcast, multicast and unicast**

MEF 6.1 Ethernet Services Definitions Phase 2

Service Type	Port-Based (All-to-One Bundling)	VLAN-Based (Service Multiplexed)
E-Line (Point-to-Point EVC)	**Ethernet Private Line** (EPL)	**Ethernet Virtual Private Line** (EVPL)
E-LAN (multipoint-to-multipoint EVC)	**Ethernet Private LAN** (EP-LAN)	**Ethernet Virtual Private LAN** (EVP-LAN)
E-Tree (rooted multipoint EVC)	**Ethernet Private Tree** (EP-Tree)	**Ethernet Virtual Private Tree** (EVP-Tree)

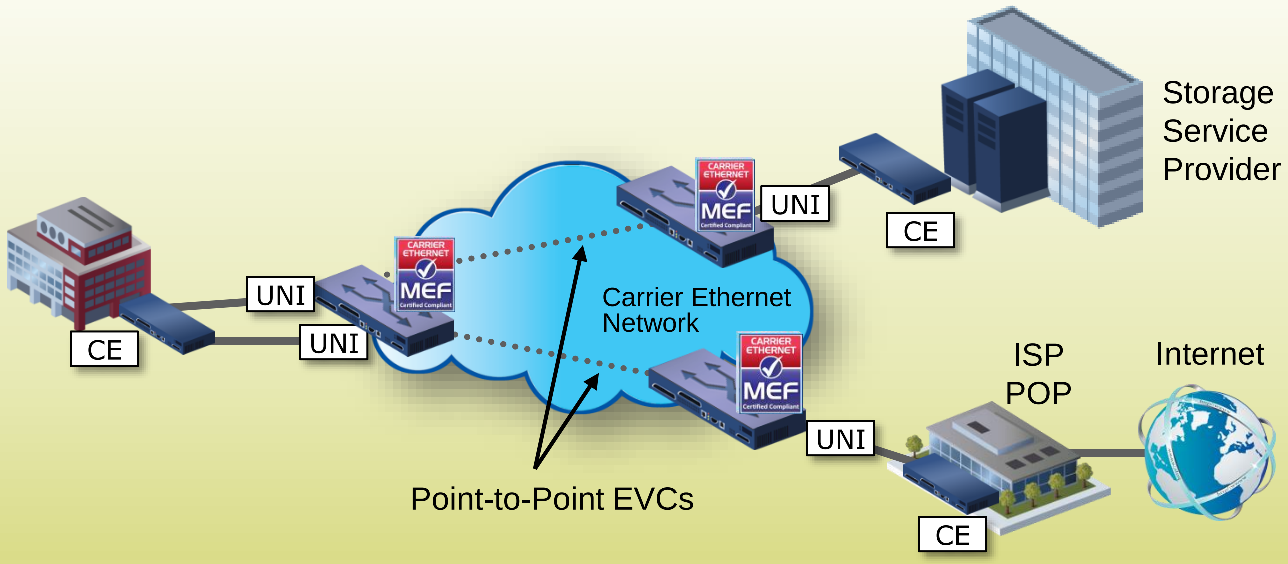
MEF 6.1 Enhancements

- **Defines a service type (E-Tree) in addition to those defined in MEF 6**
- **Adds four services – two each to E-LAN and E-Tree**
- **EPL with > 1 CoS**
- **Updates Service Attributes**
- **Updates L2CP Processing**

Services Using E-Line Service Type

Ethernet Private Line (EPL)

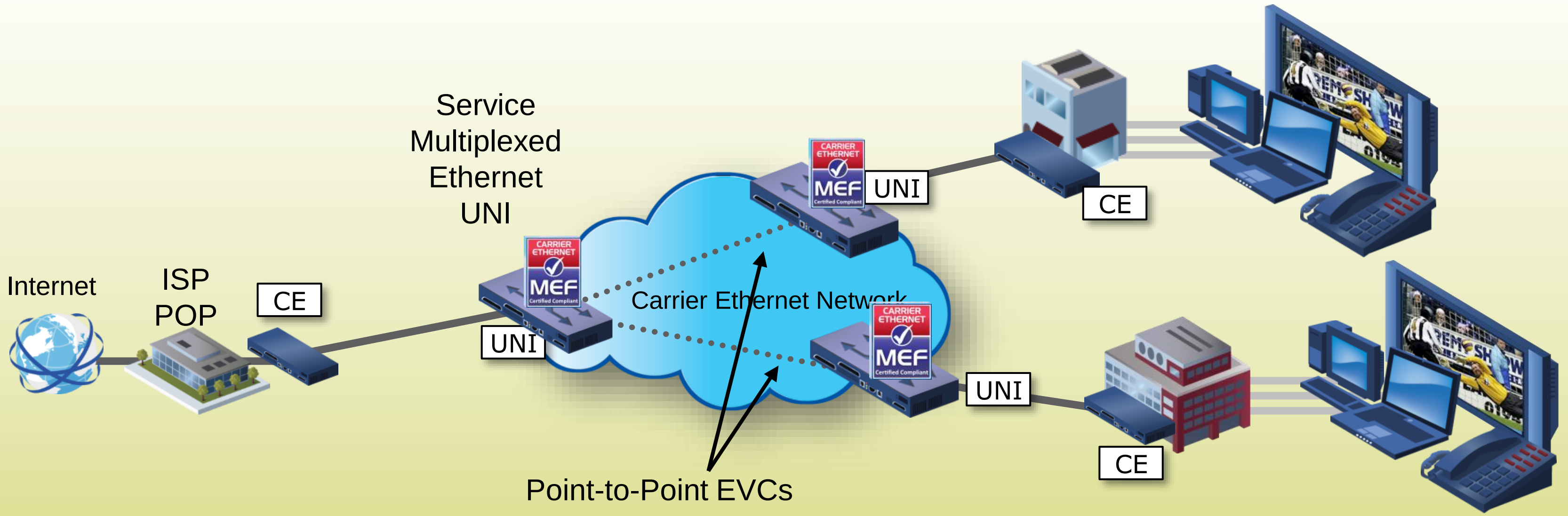
- One use case is for replacing a TDM Private line
- Port-based service with single service (EVC) across dedicated UNIs providing site-to-site connectivity
- Most popular Ethernet service due to its simplicity



Services Using E-Line Service Type

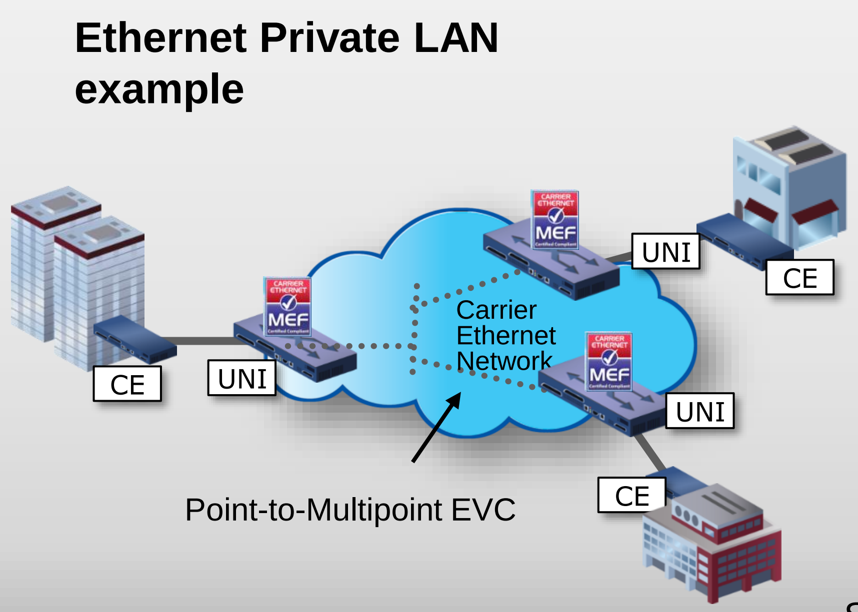
Ethernet Virtual Private Line (EVPL)

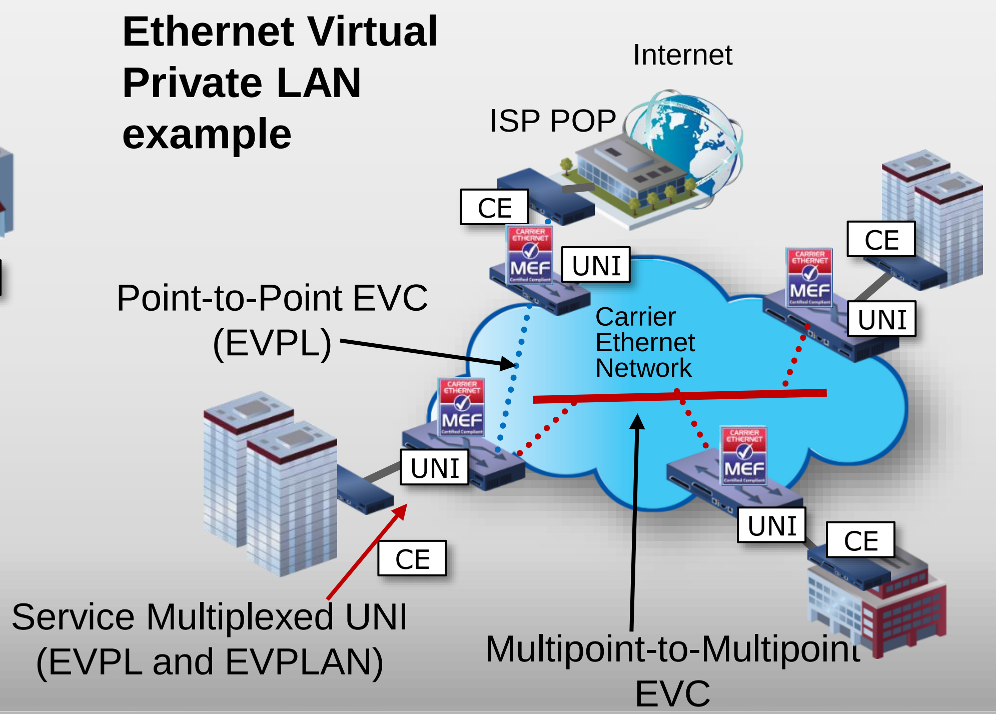
- Replaces Frame Relay or ATM L2 VPN services
  - To deliver higher bandwidth, end-to-end services
- Enables multiple services (EVCs) to be delivered over single physical connection (UNI) to customer premises



Services Using E-LAN Service Type

- **EP-LAN: Each UNI dedicated to the EP-LAN service. Example use is Transparent LAN**
- **EVP-LAN: Service Multiplexing allowed at each UNI. Example use is Internet access and corporate VPN via one UNI**



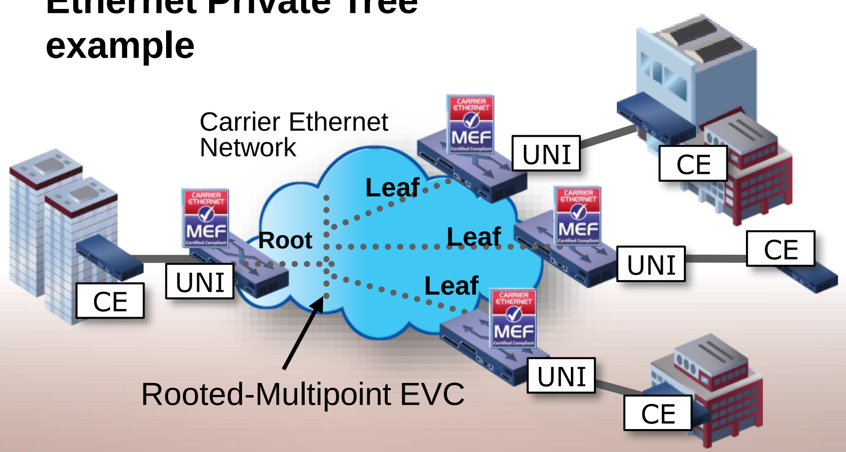


Services Using E-Tree Service Type

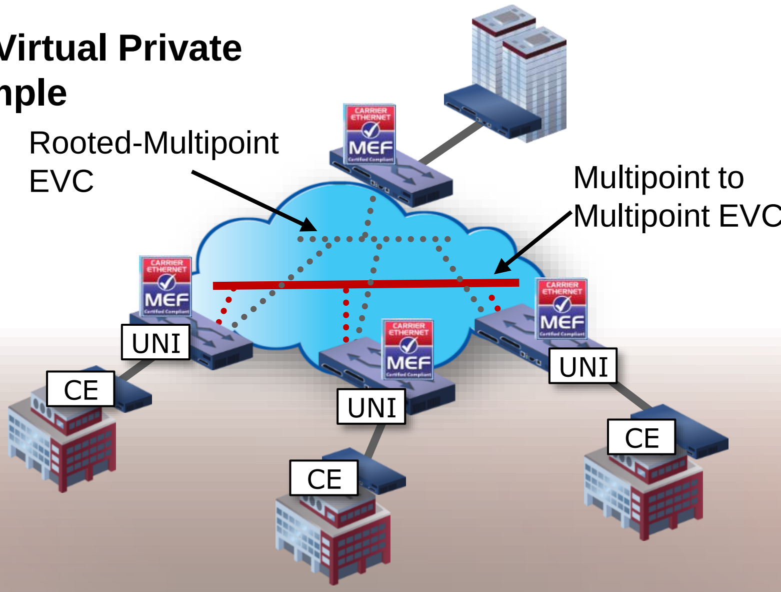
***EP-Tree and EVP-Tree:** Both allow root - root and root - leaf communication but not leaf - leaf communication.*

- **EP-Tree requires dedication of the UNIs to the single EP-Tree service**
- **EVP-Tree allows each UNI to support multiple services**

Ethernet Private Tree example



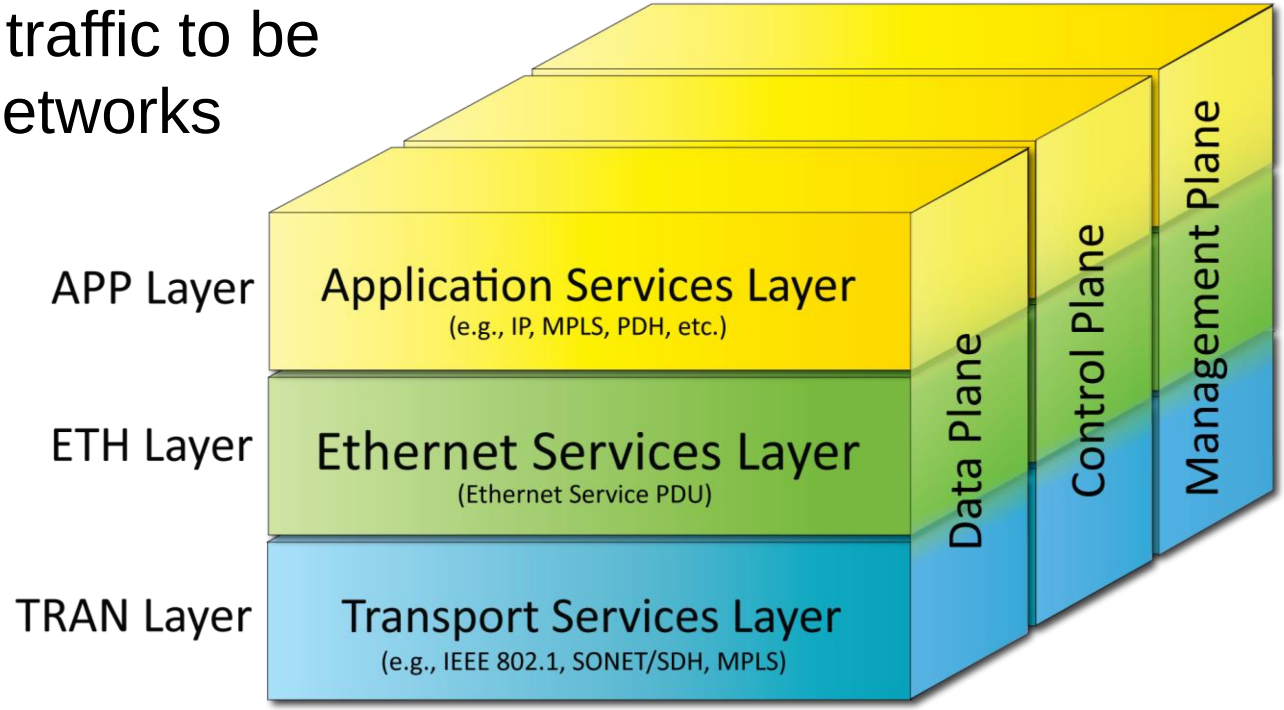
Ethernet Virtual Private Tree example



Carrier Ethernet Architecture

Data moves from UNI to UNI across "the network" with a layered architecture.

When traffic moves between ETH domains is does so at the TRAN layer. This allows Carrier Ethernet traffic to be agnostic to the networks that it traverses.



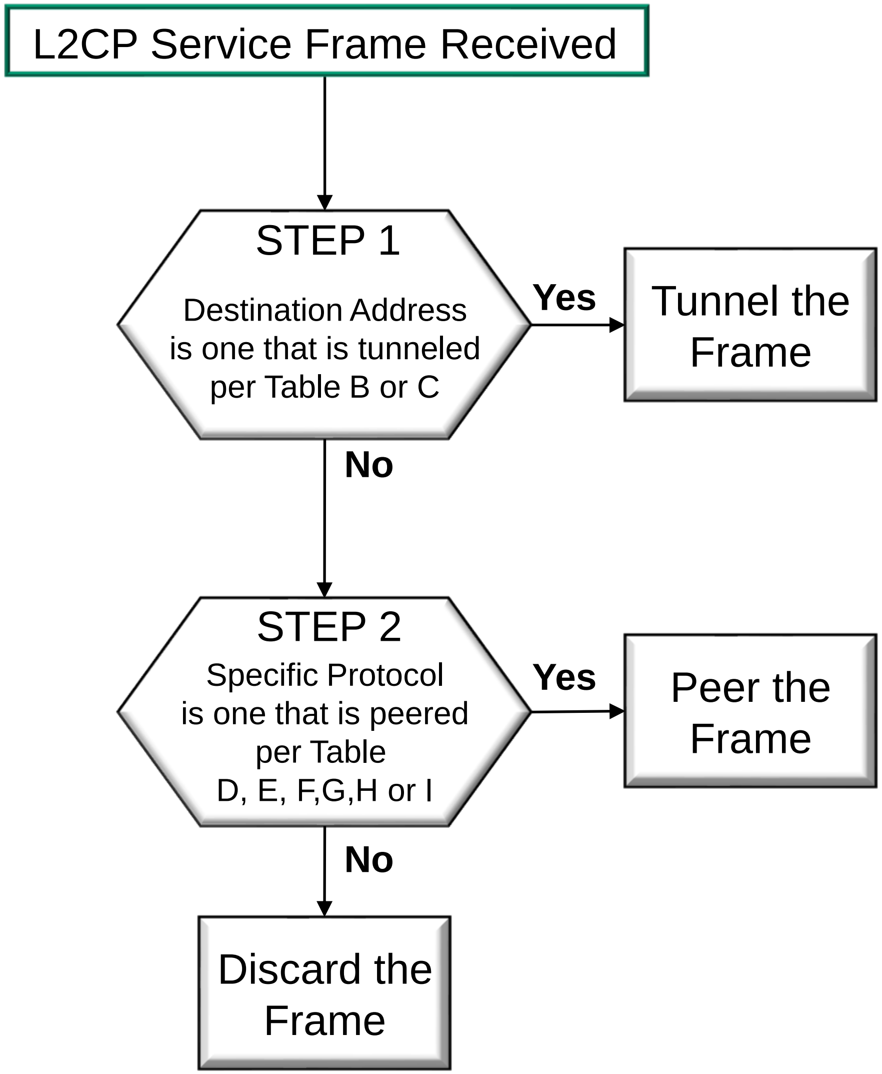
MEF

Delivery of Service Frames

- **Broadcast**
  - Deliver to all UNIs in the EVC but the ingress UNI
- **Multicast**
  - Delivered to all UNIs in the EVC but the ingress UNI
- **Unicast (unknown and known destination address**
  - Delivered to all UNIs in the EVC but the ingress UNI if unknown destination address
  - Delivered to the UNI with known destination MAC address
- **Layer 2 Control (e.g., BPDU)**
  - Discard, peer, or tunnel

Options for Layer 2 Control Protocols

- **Discard**
  - The MEN will discard ingress L2CP frames
- **Peer**
  - The MEN will actively participate with the protocol
- **Tunnel**
  - Service Frames containing the protocol will be transported across the MEN to the destination UNI(s) without change

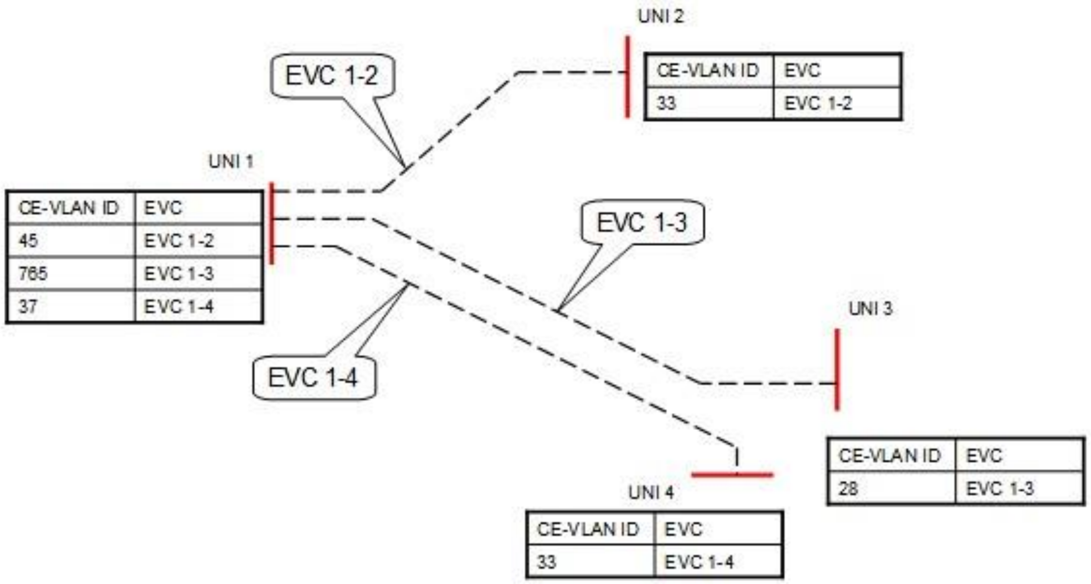


Above: The Logic Flow Chart for L2CP Service Frames

CE-VLAN ID Preservation (1)

Ethernet Virtual Private Lines to a Hub Location

- In this example, CE-VLAN Preservation = No for all EVCs (See EVC service attribute table 16 of MEF 6.1)
- Service Provider has three EVCs, each from a branch location to a hub location.
- UNI 1 is the hub location and the other UNIs are the branch locations.
- The CE-VLAN ID/EVC Maps as agreed to by the Subscriber and the Service Provider for each UNI are included in the figure.

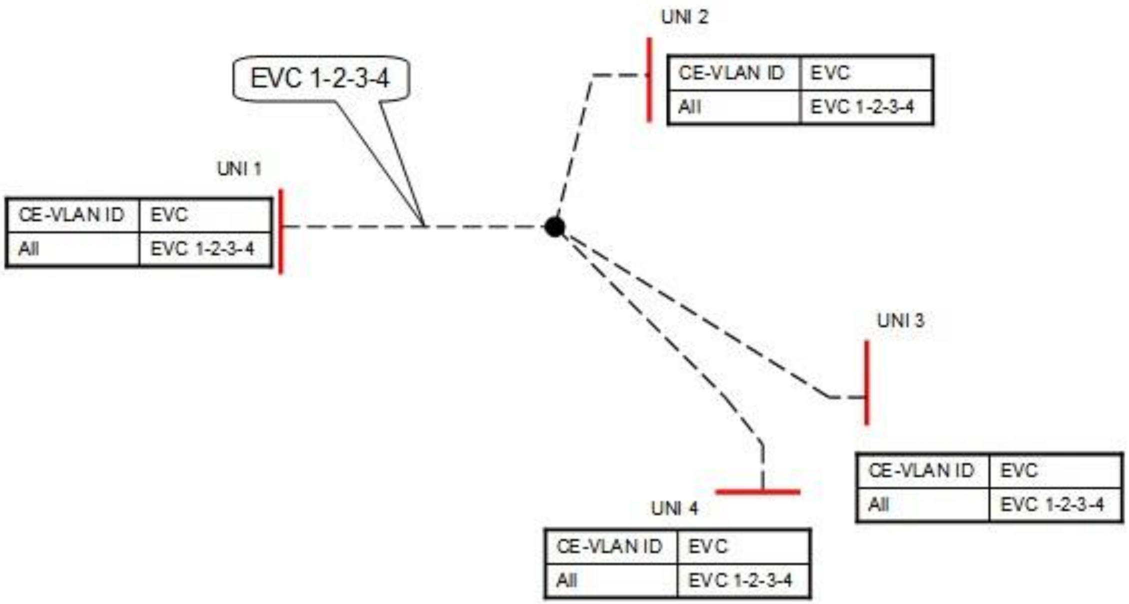


The example shows the EVCs as perceived by the Subscriber.

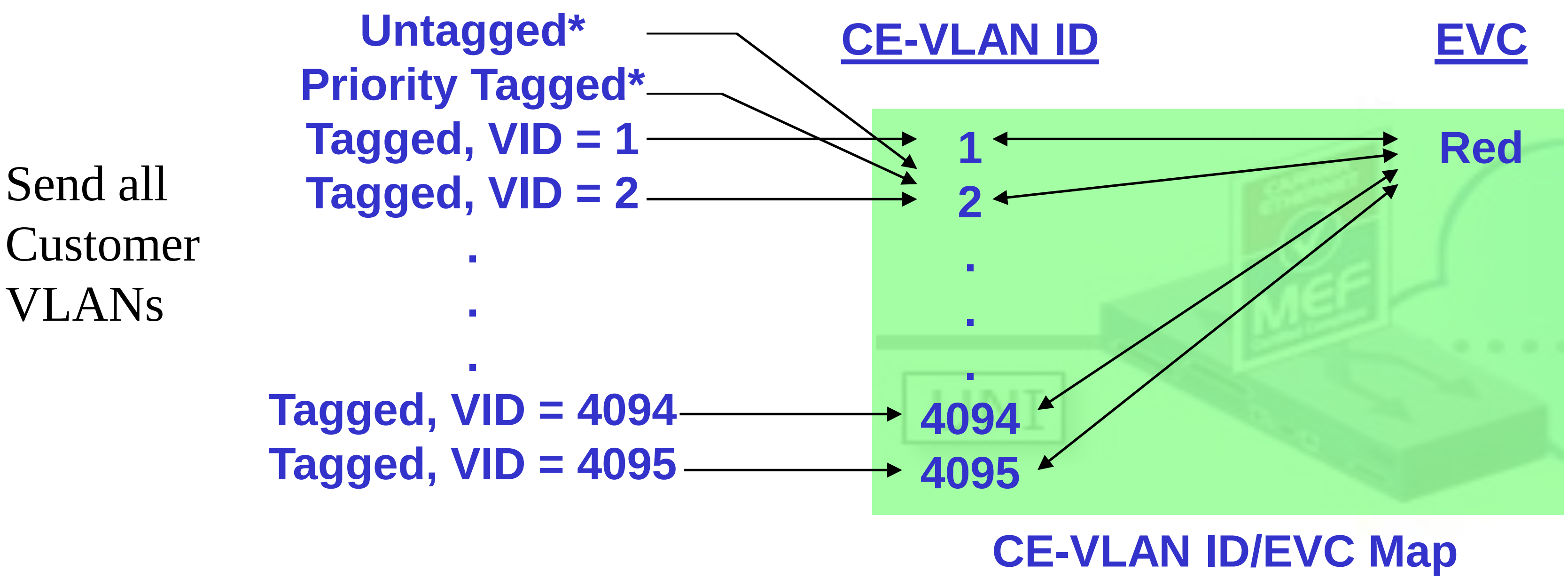
CE-VLAN ID Preservation (2)

Ethernet Private LAN

- In this example, CE-VLAN Preservation = Yes (See EVC service attribute table 20 of MEF 6.1.1)
- the Service Provider provides a single Ethernet Private LAN associating four UNIs.



All to One Bundling (Map)

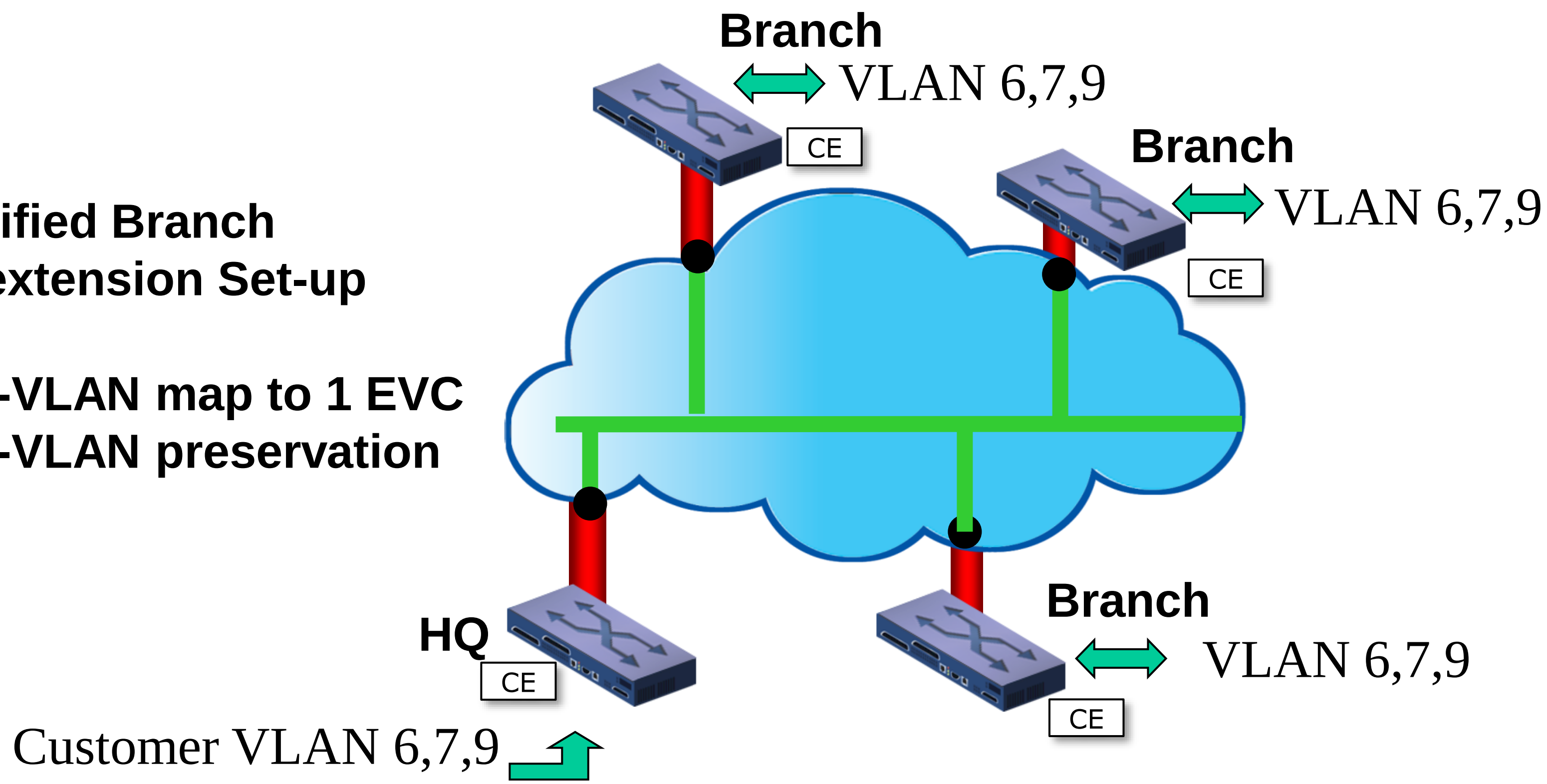


- **Only one EVC at the UNI (no service multiplexing)**
- **All CE-VLAN IDs map to this EVC – no need for coordination of CE-VLAN ID/EVC Map between Subscriber and Service Provider**
- **EVC must have CE-VLAN ID Preservation**

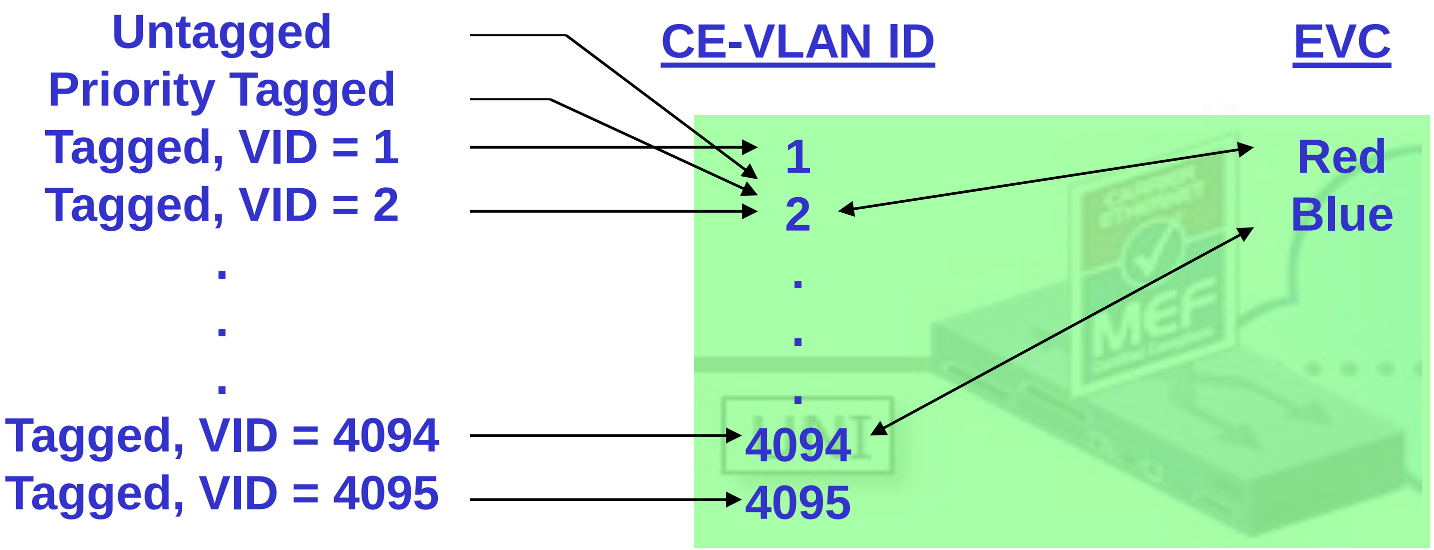
Using All to One Bundling

Simplified Branch LAN extension Set-up

- **CE-VLAN map to 1 EVC**
- **CE-VLAN preservation**



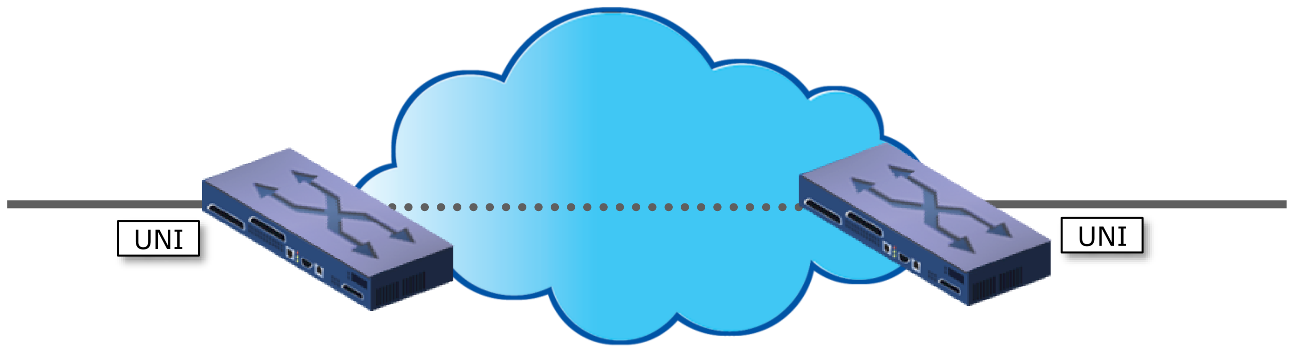
One to One Map



CE-VLAN ID/EVC Map

- Subscriber and Service Provider must coordinate CE-VLAN ID/EVC Map
- No more than one CE-VLAN ID is mapped to each EVC at the UNI
- If CE-VLAN ID not mapped to EVC, ingress Service Frames with that CE-VLAN ID are discarded
- Service Multiplexing possible
- CE-VLAN ID Preservation is optional

CE-VLAN ID Translation



CE-VLAN ID	EVC
37	Blue

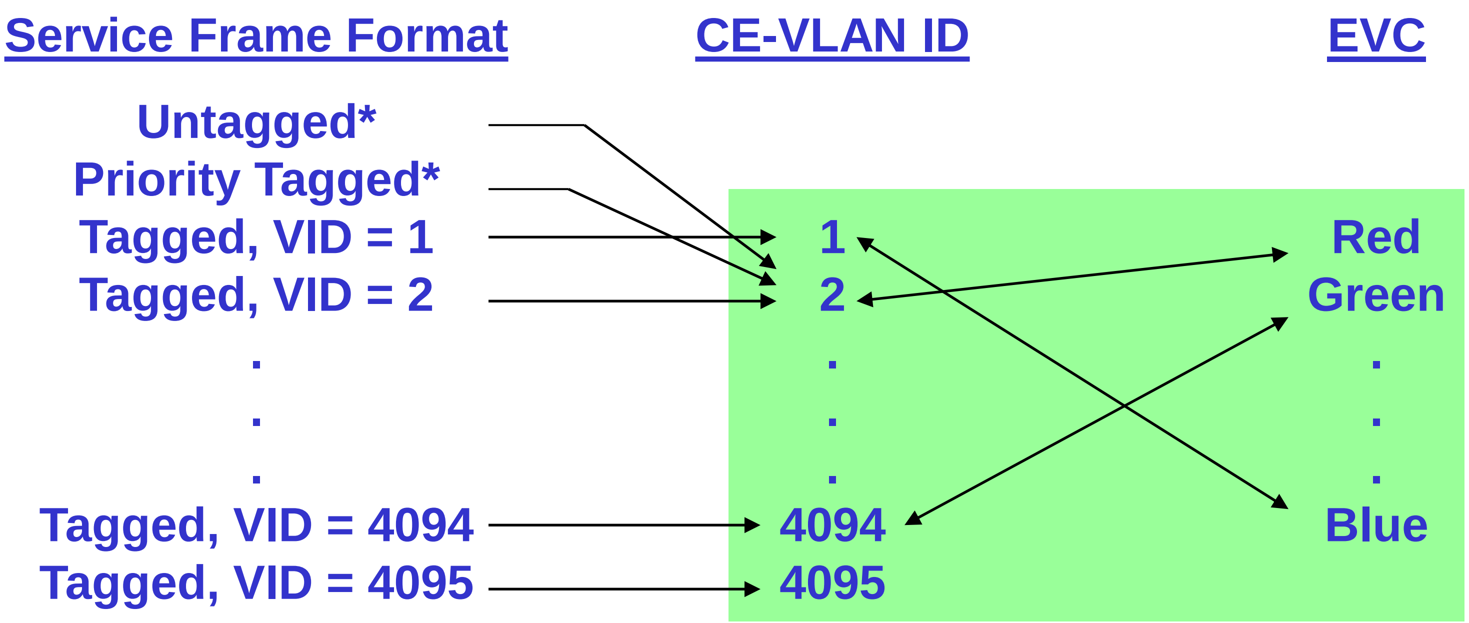
EVC	CE-VLAN ID
Blue	156

CE-VLAN ID/EVC Map can be different at different UNIs in an EVC

- **Fine for CE routers**
- **Problematic for CE bridges (depends on configuration)**

Identifying an EVC at a UNI

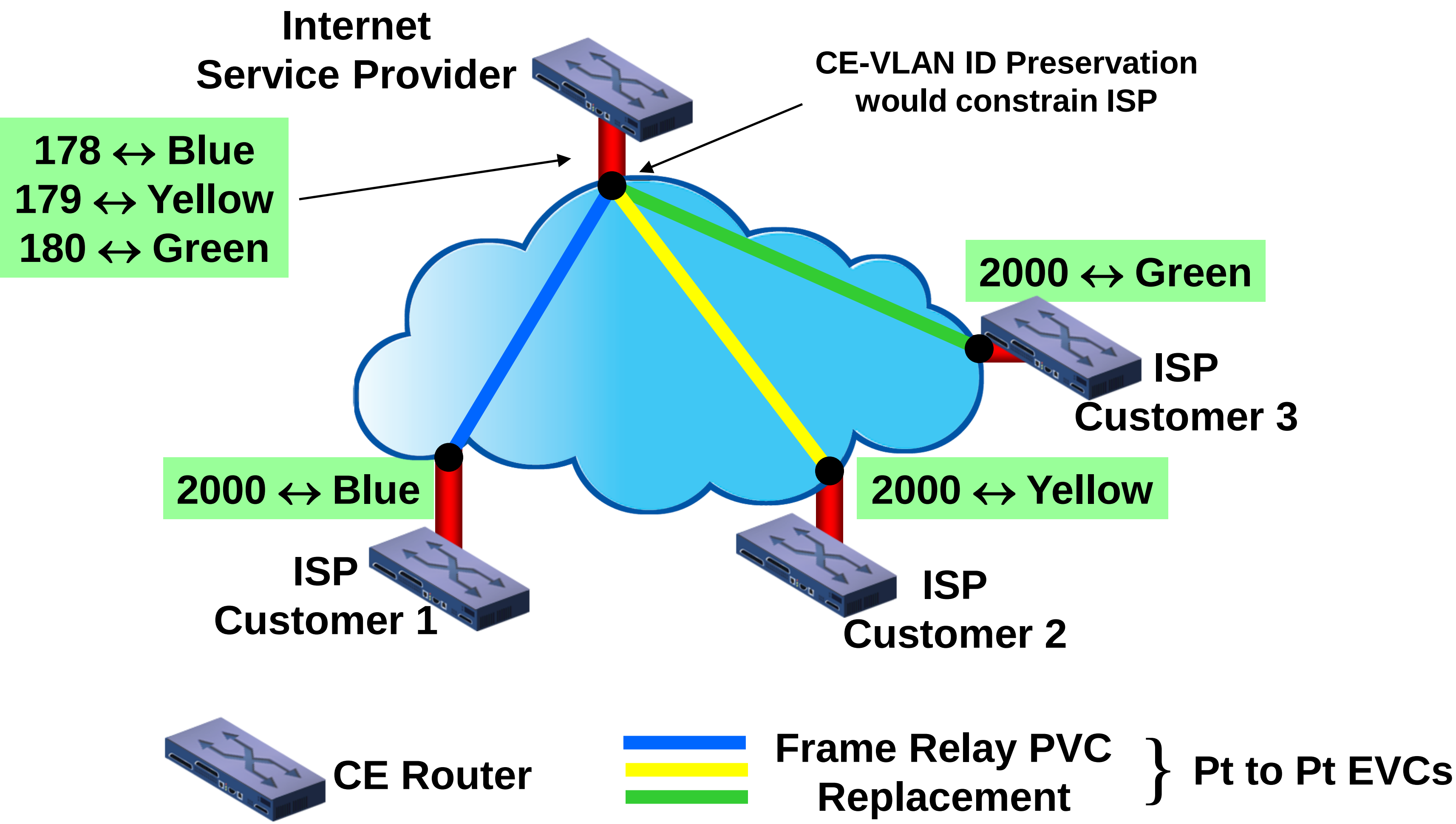
CE-VLAN ID/EVC Map



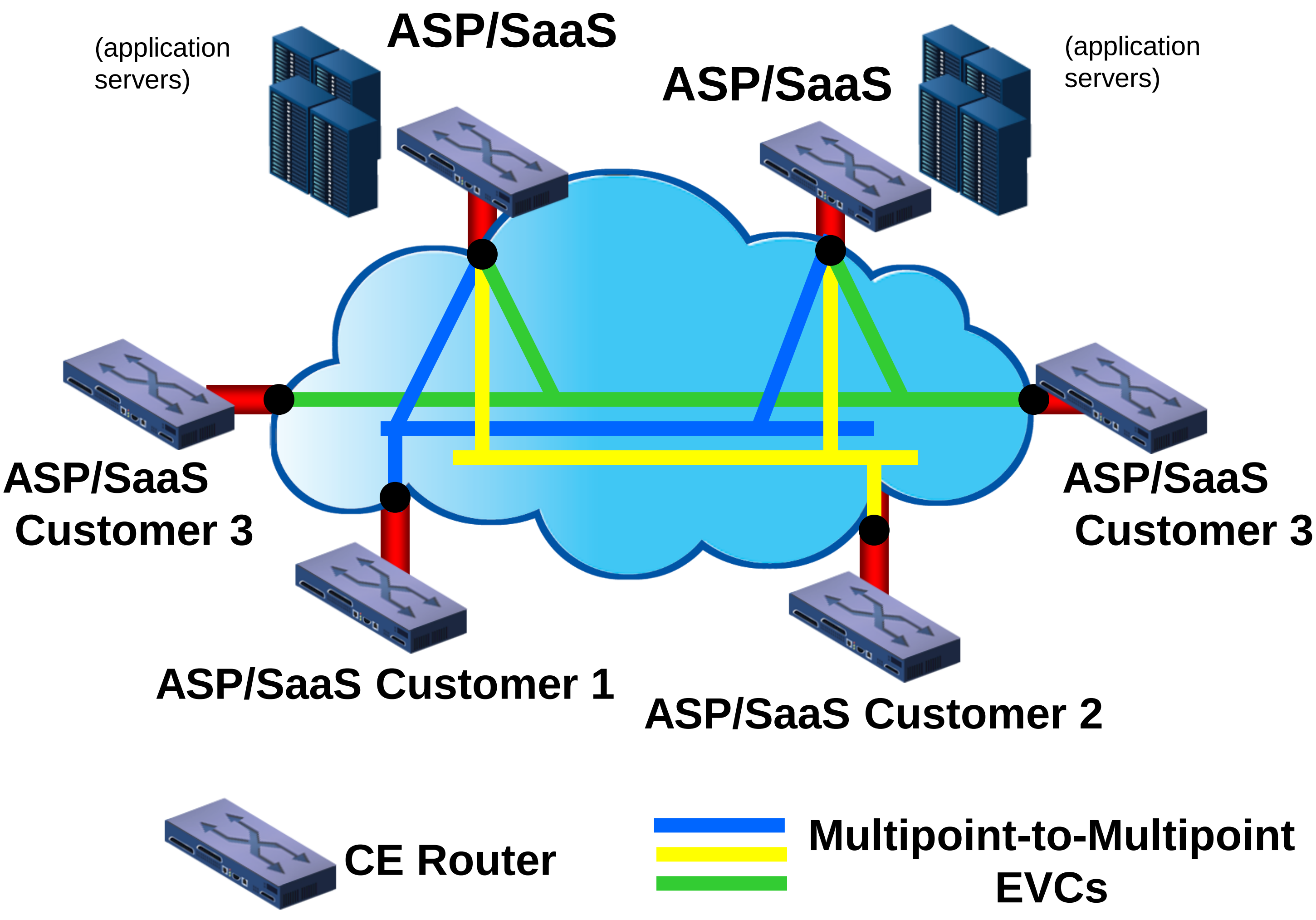
CE-VLAN ID/EVC Map

***Untagged and Priority Tagged Service Frames can have the same CE-VLAN ID. (depends on use case) Configurable at each UNI. This is the behavior expected by an IEEE 802.1Q CE.**

Using One to One Map w/ Translation – 1

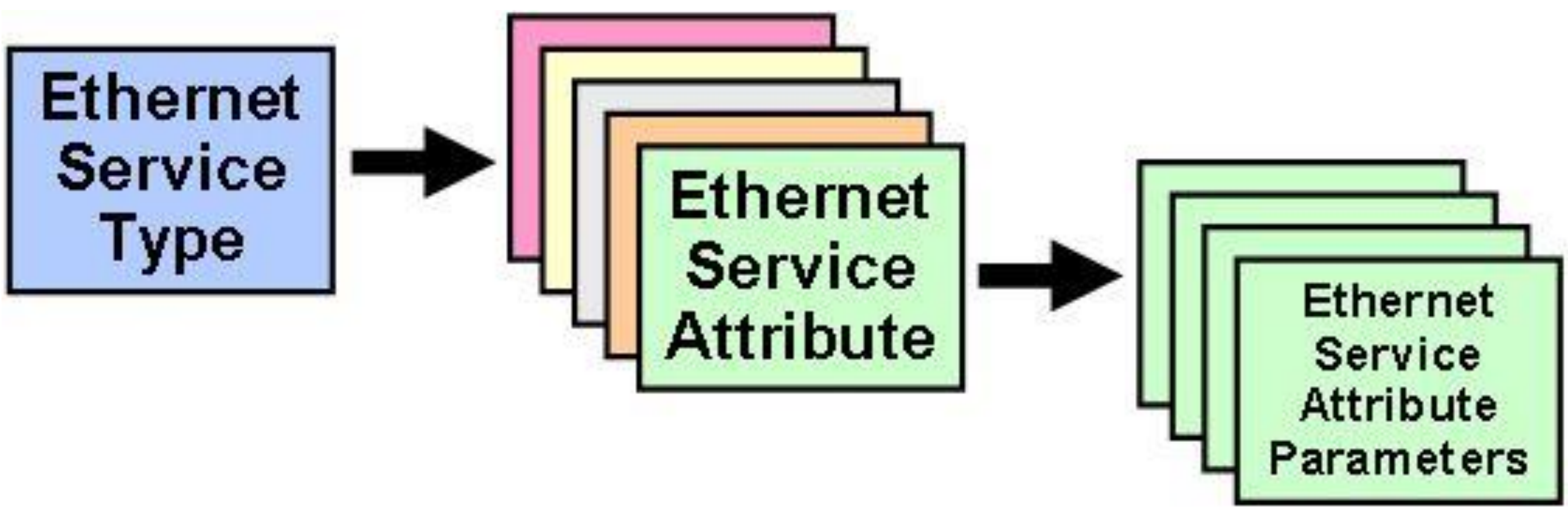


Using One to One Map – 2



Industry Service Requirements

- **For services are to be adopted in the market:**
  - They require strong service attributes
  - With meaningful and measurable parameters on which to base the SLA Specification



The Best Of All Worlds

- **Offer a mix of SLA "ensured" and non SLA traffic**
  - Over the same "shared" MEN access/backbone links.
  - Allow certain traffic be delivered with strict SLAs (Service Level Agreements),
  - Allow other traffic to be delivered best efforts.
- **Critical SLA Service Attributes**
  - Bandwidth Profile
  - Service Performance
- **Allows bandwidth to exceed commitments**
  - But does not apply SLA conformance measures to that traffic

How to Classify the Traffic

- **Apply Bandwidth Profiles (MEF 10.2)**

  The Bandwidth Profile is the set of traffic parameters that define the maximum limits of the customer's traffic

  – An Ingress Bandwidth Profile limits traffic transmitted into the network,
    - Each Service Frame is checked for compliance against the profile
    - Separately definable for each UNI (MEF 10.2)
    - Service frames that meet the profile are forwarded
    - Service frames that do not meet the profile are dropped at the interface

  – An Egress Bandwidth Profile
    - Could be applied anywhere in the network to control the focused overload problem of multiple UNIs sending to an egress UNI simultaneously

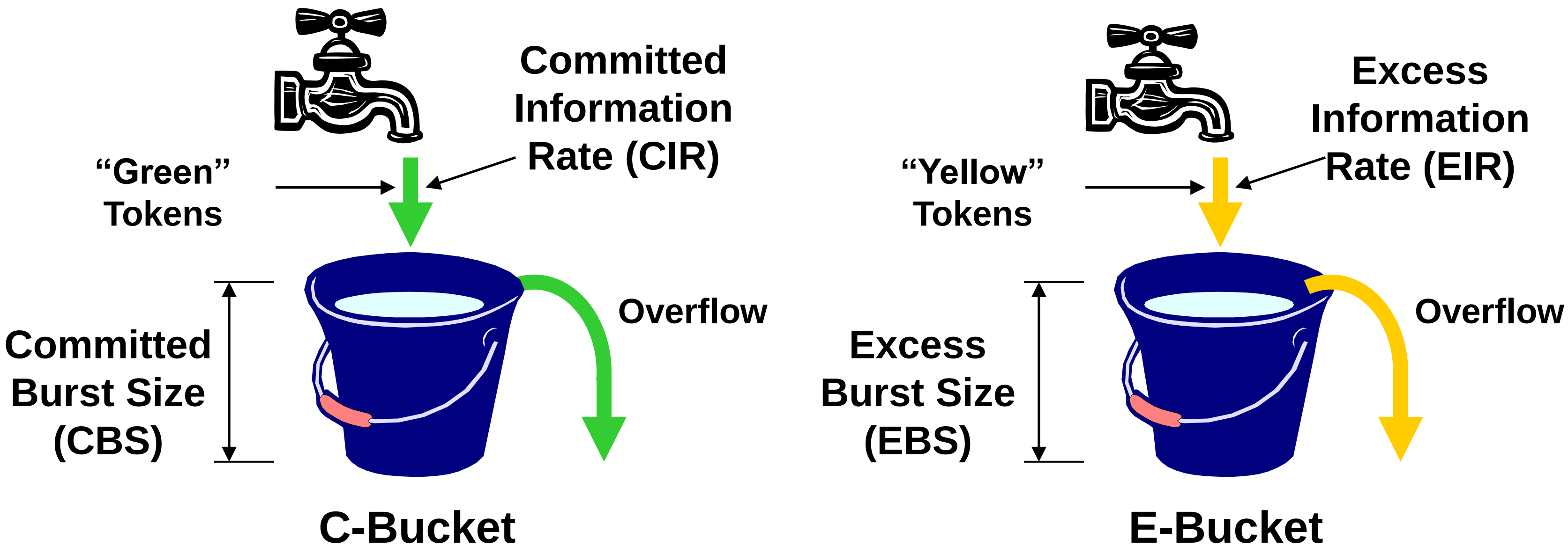
Coloring Classified Traffic

- **MEF 10.2 specifies three levels of Bandwidth Profile compliance for each individual Service Frame**
  - **Green**: Service Frame subject to SLA performance guarantees
  - **Yellow**: Service Frame not subject to SLA performance guarantees, but will be forwarded on a “best effort” basis. They have lower priority and are discard-eligible in the event of network congestion.
  - **Red**: Service Frame discarded at the UNI by the traffic policer

Bandwidth Profile Parameters

- Customers are allowed a combination of rate and burst
- Green frames conform to the Committed Information Rate (CIR) and Committed Burst Size (CBS) limits
- Yellow frames conform to the Excess Information Rate (EIR) and Excess Burst Size (EBS) limits
- In Color Mode (CM) unaware service, the service provider will mark the frames green or yellow solely according to each frame’s arrival time
- Customers may have the option of marking their frames green or yellow themselves (Color Mode aware) to better allow them to utilize their CIR/CBS/EIR/EBS bandwidth profile
- In Color Mode aware service there may be an optional Coupling Flag (CF) that can be enabled to allow customers to better utilize unused tokens from the committed token bucket (unused CIR/CBS capacity)
- The total set of Bandwidth Profile Parameters is CIR/CBS/EIR/EBS/CM/CF

Bandwidth Profile Defined by Token Bucket Algorithm (2 rates, 3 colors)

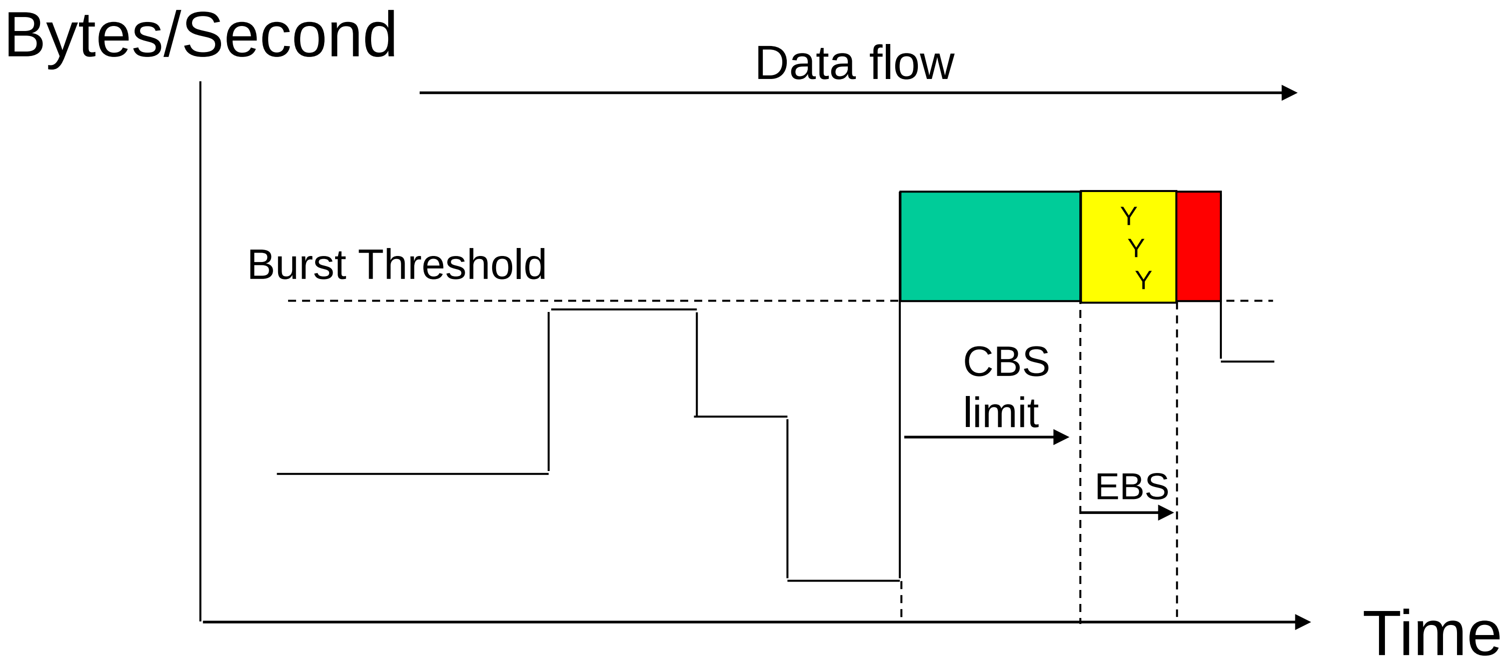


<u>**Color Blind Algorithm:**</u>

If (Service Frame length is less than C-Bucket tokens)
{declare green; remove tokens from C-Bucket}
else if (Service Frame length is less than E-Bucket tokens)
{declare yellow; remove tokens from E-Bucket}
else declare red

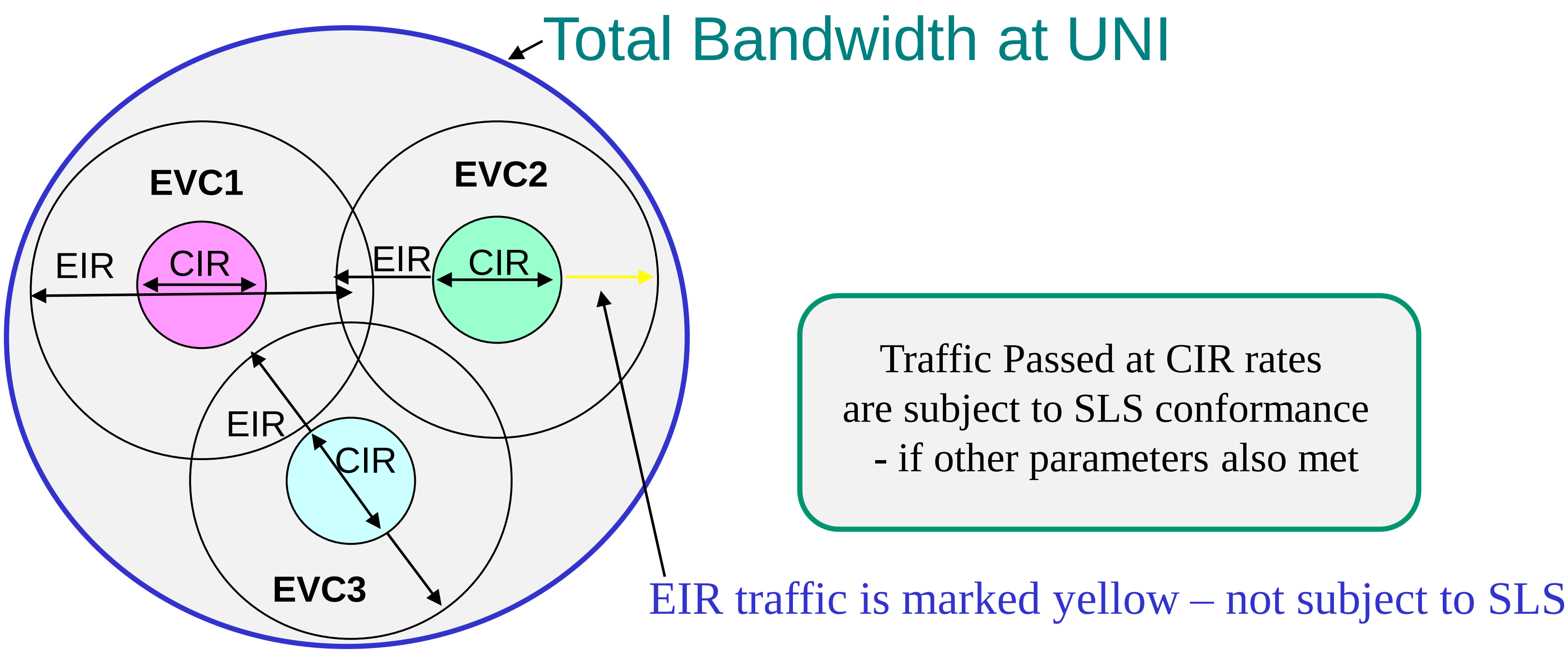
CBS vs. EBS

- **Burst size in Bytes per second allowed**
  - CBS marked Green, EBS is Yellow,
  - Bursts beyond EBS limit is discarded



CIR vs. EIR Service Example

- **Conceptual Example**
  - 3 EVCs share fixed UNI bandwidth
  - 3 CIRs can always be met
  - 3 EIRs can not always be assured (simultaneously)



Traffic Passed at CIR rates
are subject to SLS conformance
- if other parameters also met

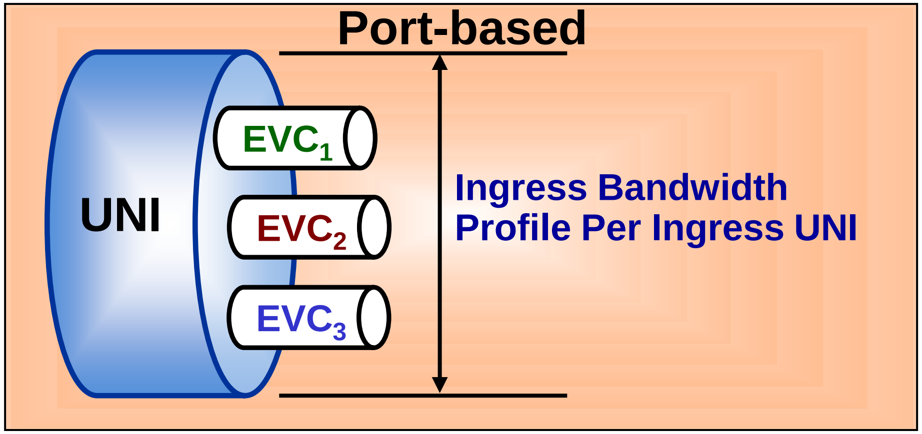
Application of Bandwidth Profiles

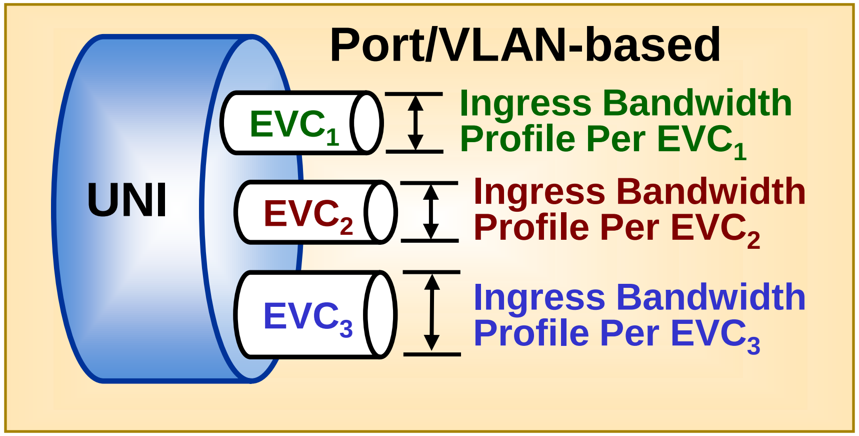
- **Bandwidth profiles may be applied with 3 layers of granularity:**
  - Ingress Bandwidth Profile Per Ingress UNI
  - Ingress Bandwidth Profile Per EVC
  - Ingress Bandwidth Profile Per CoS ID

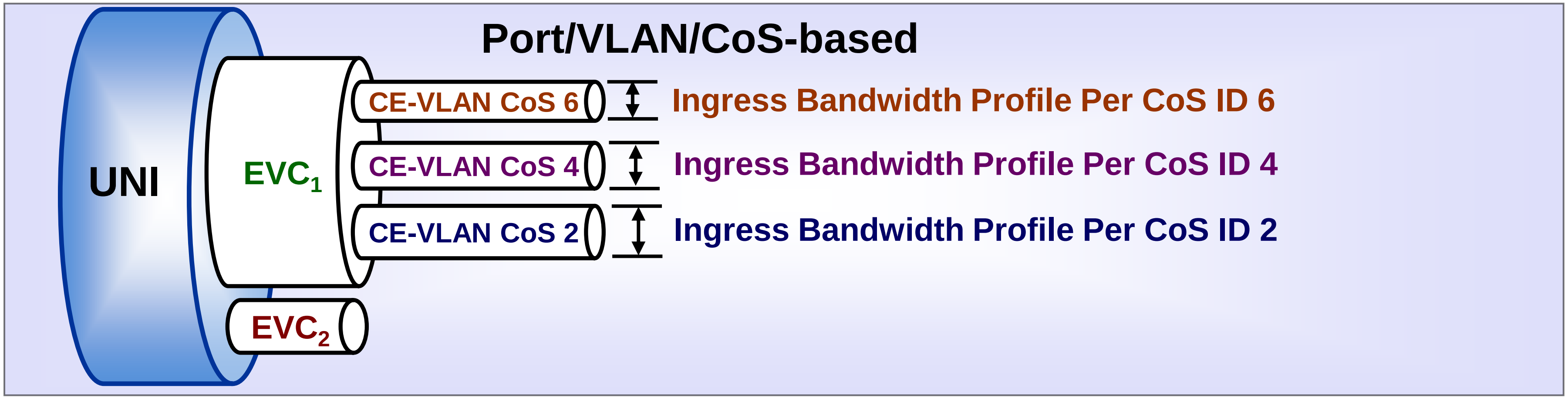
Note: Only one profile may be applied to a given service name

Port, EVC, and VLAN based BWPs

Three Types of Bandwidth Profiles Defined in MEF 10.1







Two Ways to Identify CoS Instance

- **EVC**
  - All Service Frames mapped to the same EVC receive the same CoS
- **EVC, priority marking**
  - All Service Frames mapped to an EVC with one of a set of user priority values receive the same Class of Service
  - The user may be able to mark the priority with 802.1Q Priority bits in the VLAN Tag Priority Code Point (C-TAG)
  - The user may be able to mark the priority with IP DSCP bits
  - L2CP can have their own CoS ID

EVC Related Performance Service Attributes

- **Five performance attributes are considered in MEF 10.2.1**
  - Frame Delay Performance
    - a) Frame Delay
    - b) Frame Delay Range
    - c) Mean Frame Dela

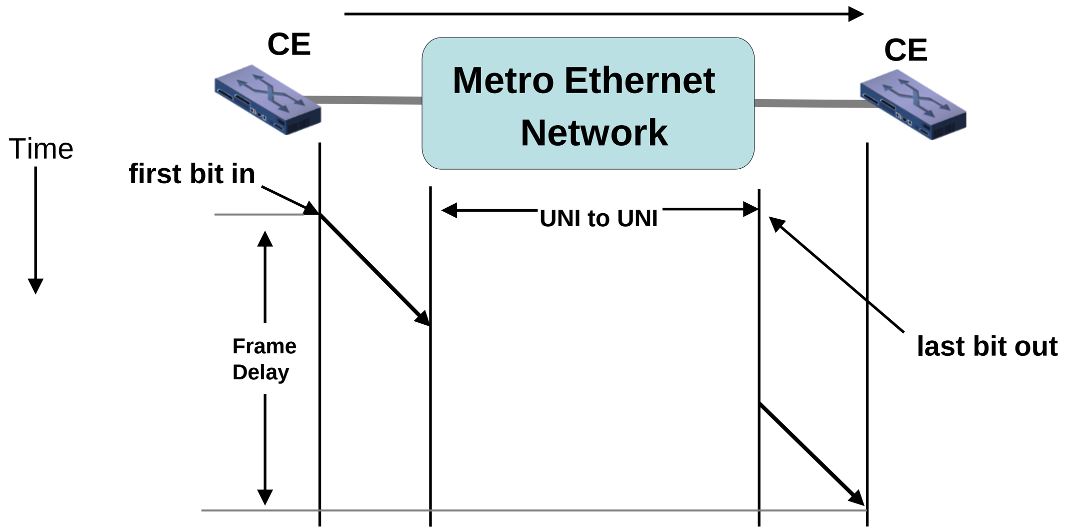
Frame Delay and Delay Variation

- **Frame Delay**
  - This is measured as the time taken for service frames to cross the network
  - Frame Delay is measured from the arrival of the first bit at the ingress UNI to the output of the last bit of the egress UNI. I.e. an end-to-end measurement as the customer views it.

- **Inter Frame Delay Variation**
  - Frame Delay Variation is therefore the variation in this delay for a number of frames. This delay is an important factor in the transmission of unbuffered video and where variation occurs in the millisecond range can affect voice quality. For data can cause a number of undesirable effects such as perceived frame loss, etc

Frame Delay Performance

- **One-way Frame Delay Performance for an EVC**
  - Defines three performance attributes: the One-way Frame Delay Performance corresponding to a percentile of the distribution, the One-way Mean Frame delay, and the One-way Frame Delay Range.

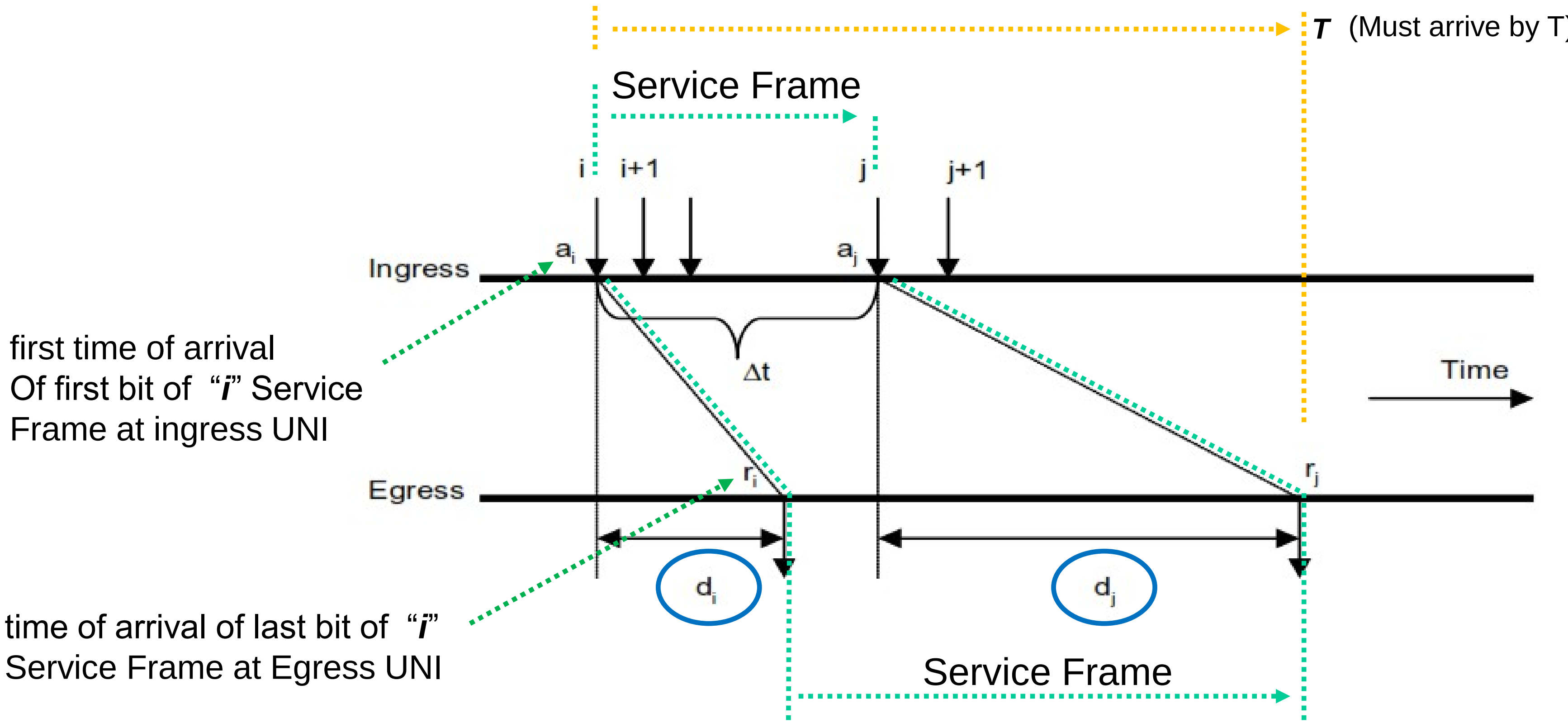


  - The One-way Frame Delay for an egress Service Frame at a given UNI in the EVC is defined as the time elapsed from the reception at the ingress UNI of the first bit of the corresponding ingress Service Frame until the Transmission of the last bit of the Service Frame at the given UNI. This delay definition is illustrated above

Frame Delay Performance

- **Inter-Frame Delay Variation Performance for Point-to-Point EVC**
  - **Inter-Frame Delay Variation (IFDV):** The difference between the one-way delays of a pair of selected Service Frames. (same as in RFC3393 [6] where IP packet delay variation is defined.)
  - **The Inter-Frame Delay Variation Performance:** The "P-percentile" of the absolute values of the difference between the Frame delays of all Qualified Service Frame pairs if the difference in the arrival times of the first bit of each Service Frame at the ingress UNI was exactly Δt.
    - This definition agrees with IP packet delay variation definition where delay variation is defined as the difference between the one-way delay of two packets selected according to some selection function and are within a given interval $[T_1, T_2]$
    - Inter-Frame Delay Variation Performance depends on the choice of the value for Δt. *Values for* both Δt *and T typically should be chosen to achieve a reasonable level of statistical accuracy.*

Inter-Frame Delay Variation Performance (Example)



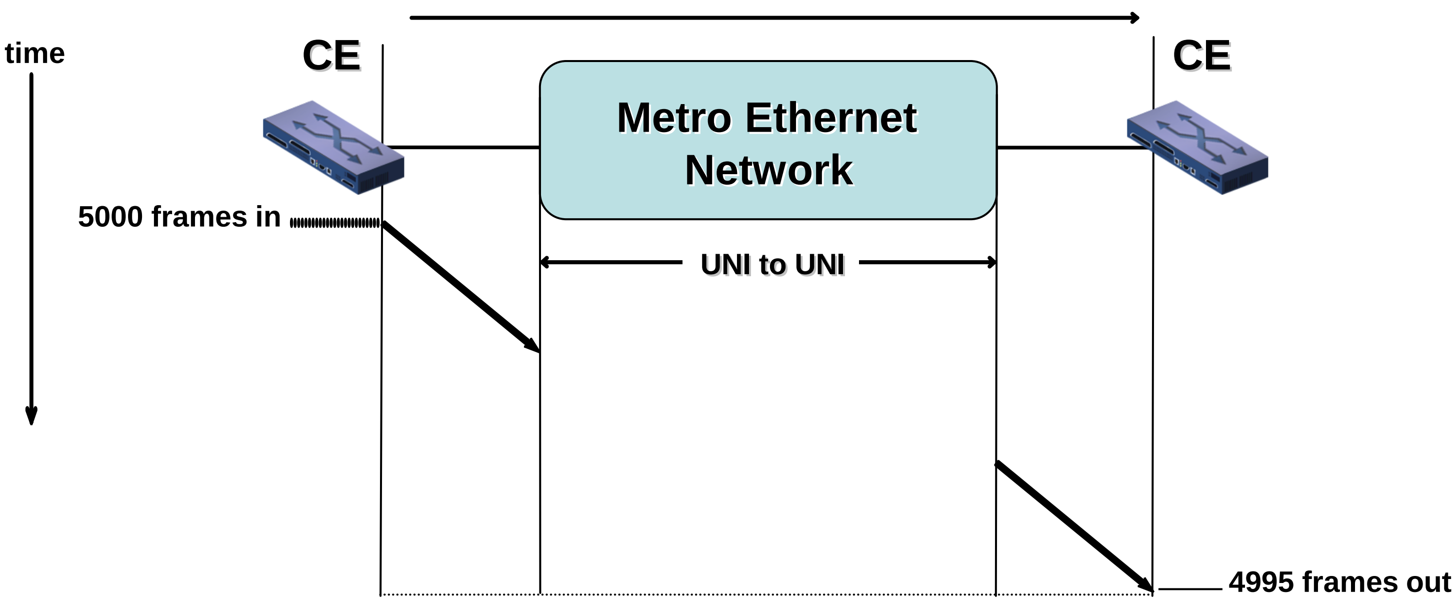
The difference in delays encountered by frame ***i*** and ***j*** is given by $d_i – d_j$

For a particular Class of Service instance, Inter-Frame Delay Variation Performance metrics may be specified over any given subset of two or more UNIs on an EVC

MEF

Frame Loss Ratio (FLR)

- **Frame loss is a measure of the number of lost service frames inside the MEN**
  – Frame loss ratio is % = # frames lost / # frames sent



5 frames lost/or received as errored
0.1% Frame Loss Ratio (5/5000)

Frame Loss Ratio Performance

- **One-way Frame Loss Ratio Performance for an EVC**
  - There may be multiple One-way Frame Loss Ratio Performance metrics defined for a particular Class of Service instance on an EVC.
  - Each such metric is based on a subset of the ordered pairs of UNIs in the EVC for a time interval "*T*".
  - One-way Frame Loss Ratio Performance metric is defined as follows:

$$FLR_{T,S} = \begin{cases} \max\left\{FLR_T^{\langle i,j\rangle} \mid \langle i,j\rangle \in S \text{ and where } I_T^{\langle i,j\rangle} \geq 1\right\} \\ \mathit{Undefined} \text{ when all } I_T^{\langle i,j\rangle} = 0 \mid \langle i,j\rangle \in S \end{cases}.$$

  - a One-way Frame Loss Ratio Performance metric entry must specify a set of parameters and an objective. The parameters and objective of a One-way Frame Loss Ratio Performance metric are referenced in Table 6 of MEF 10.2.
  - Given *T, S, and a One-way Frame Loss Ratio Performance objective, the One-way Frame Loss* Performance SHALL be defined as met over the time interval *T for the subset S if and only if* $FLR_{T,S} \leq \hat{L}$.

Availability & Resilience Performance

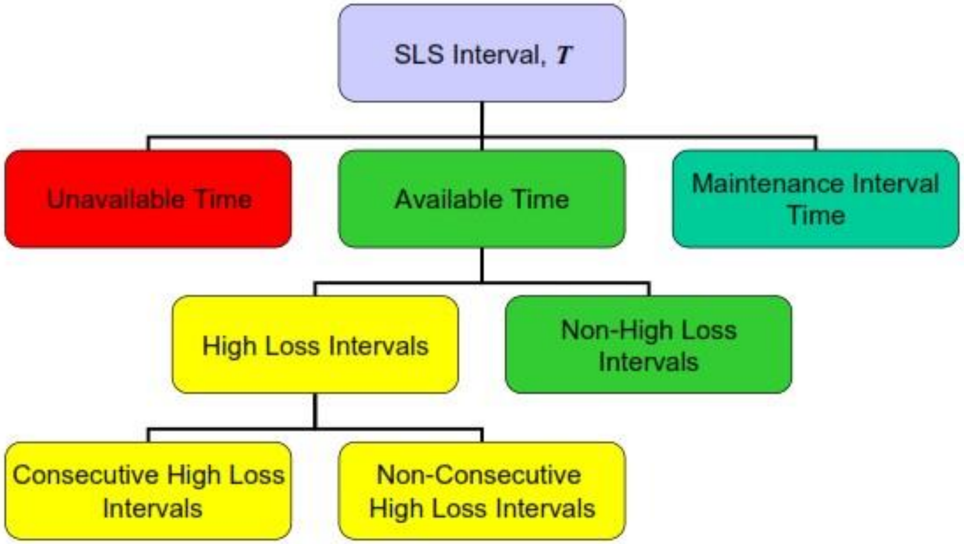
One-way Availability Performance for an EVC

- Availability Performance is based on Service Frame loss during a sequence of consecutive small time intervals and the availability state during the previous small time interval; it is the percentage of time within a specified time interval during which the frame loss is small.

– if frame loss is high for each small time interval in the current sequence, then the small time interval at the beginning of the current sequence is defined as unavailable; otherwise it is defined as available.

One-way Resiliency Performance for an EVC

The figure to the right illustrates how the two resiliency attributes defined here, counts of High Loss Intervals and counts of Consecutive High Loss Intervals, fit into the hierarchy of time and other attributes



Availability Parameters

Parameter	Description
T	The time interval
S	Subset of the UNI pairs (used for Multipoint EVC)
Δt	A time interval much smaller than T
C_u	Unavailability frame loss ratio threshold
C_a	Availability frame loss ratio threshold with $C_a \leq C_u$
n	Number of consecutive small time intervals for assessing availability
$\hat{A}$	Availability Performance objective

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UNI-oriented Availability Example

- **In this case, an Availability Performance metric is defined for each UNI for each Class of Service. The metric is based on the ability to communicate between the UNI in question and the other UNIs identified by the important traffic flows. Define the following subsets of UNI pairs:**
  - $S_{A,1} = \{\langle A,B\rangle, \langle A,C\rangle, \langle A,D\rangle, \langle A,E\rangle\}$
  - $S_{B,1} = \{\langle B,A\rangle, \langle B,C\rangle, \langle B,D\rangle, \langle B,E\rangle\}$
  - $S_{C,1} = \{\langle C,A\rangle, \langle C,B\rangle\}$
  - $S_{D,1} = \{\langle D,A\rangle, \langle D,B\rangle\}$
  - $S_{E,1} = \{\langle E,A\rangle, \langle E,B\rangle\}$
  - $S_{A,2} = \{\langle A,C\rangle, \langle A,E\rangle\}$
  - $S_{C,2} = \{\langle C,A\rangle, \langle C,E\rangle\}$
  - $S_{E,2} = \{\langle E,C\rangle, \langle E,A\rangle\}$
- For this example, assume that *T*, , , , and *n*, are used for all availability definitions. Then using the definition in Section 6.8.4, can be viewed as the availability of UNI A for Class of Service 1 and this reflects the availability of the important point to point paths that UNI A is a part of. Similarly, can be viewed as the availability of UNI C for Class of Service 2

EVC-oriented Availability Example

- **In this case, Availability Performance metric is defined for each Class of Service supported by the EVC**

  - $S_1 = \{\langle A,B\rangle, \langle A,C\rangle, \langle A,D\rangle, \langle A,E\rangle, \langle B,C\rangle, \langle B,D\rangle, \langle B,E\rangle\}$
  - $S_2 = \{\langle A,C\rangle, \langle A,E\rangle, \langle C,E\rangle\}$

- For this example, assume that *T*, , , , and *n*, are used for both availability definitions. Then using the definition in Section 6.8.4, can be viewed as the availability of Class of Service 1 on the EVC and can be viewed as the availability of Class of Service 2 on the EVC.

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High Loss Interval/Consecutive High Loss Interval

- High Loss Interval (HLI) is a small time interval contained in T (having the same duration as the interval, with a high frame loss ratio.
- When sufficient HLIs are adjacent, the interval is designated as a Consecutive High Loss Interval (CHLI)

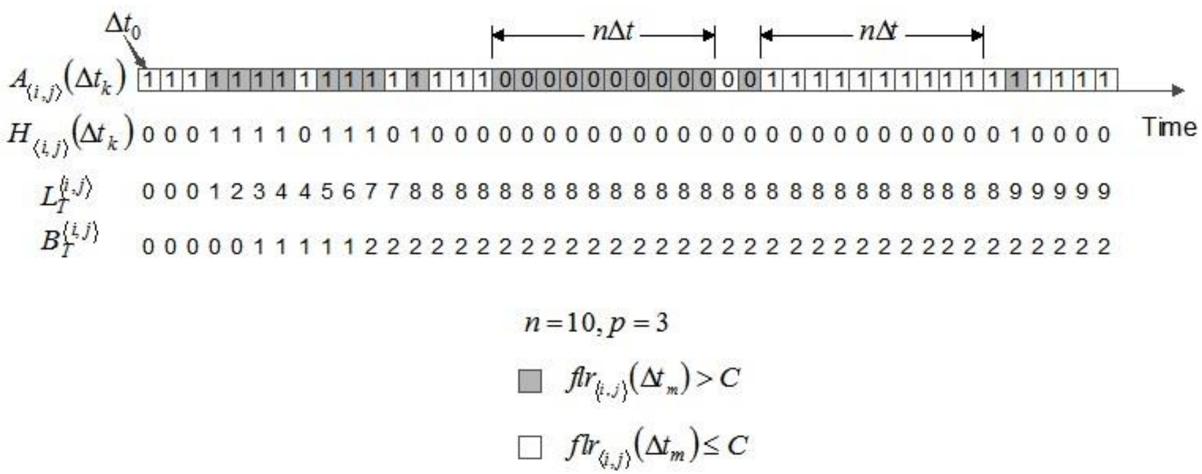

Figure 12 shows an example that depicts the HLI and CHLI counting processes.

Summary

Summary

- MEF 6.1.1 modifies MEF 6.1 with respect to Layer 2 Control Protocol processing requirements, and provides a closer alignment to IEEE 802.1 specifications.

- MEF 10.2 defines the attributes of Ethernet Services observable at a User Network Interface (UNI) and from User Network Interface to User Network Interface (UNI to UNI) and a framework for defining specific instances of Ethernet Services.

- The 10.2.1 modifies and enhances MEF 10.2 in the definition of Qualified Service Frames, Availability, new performance attributes for resiliency performance and adds new terms.

Final Word

- **Service Attributes & Parameters**
  – Ethernet Private Line, Ethernet Virtual Private Line, Ethernet LAN attributes and parameters are covered in detail in the specifications

- **Next Actions**
  – After reading this document you should now be familiar with the main concepts of Ethernet Services and be in a position to follow the details contained in both the MEF 6.1 and MEF 10.2 and 10.2.1 Specifications

MEF

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